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SURFACE LIGHT SOURCE DEVICE

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Abstract

PROBLEM TO BE SOLVED: To prevent the darkening of corner portions of a light incident face for a surface light source device using a comparatively small light source compared with the dimension of a light guide panel and make brightness distribution uniform by forming an optical pattern at an opposite place to the light source for the light incident face of the light guide panel which shuts in light led-in from the light incident face and extracts the light outward from a light emission face.

SOLUTION: A light (f) emitted from a light emitting section opposed to an optical pattern 35 of a prism array state is not led into the light guide panel due to forward deflected light. The light is led to the inside of the light guide panel 22 in a wide range by refraction through each prism that constitutes the optical pattern 35. The light reaches even the corner portions of both sides of the light incident face 26 and the brightness distribution of the surface light source device is made uniform when the corner portions becomes bright. The light incident on the light guide panel 22 from the light emitting section is uniformly emitted at each region of the light guide panel 22 and uniform brightness distribution is obtained in the whole surface of the light guide panel 22 since a diffused pattern is formed at the bottom face of the light guide panel 22.

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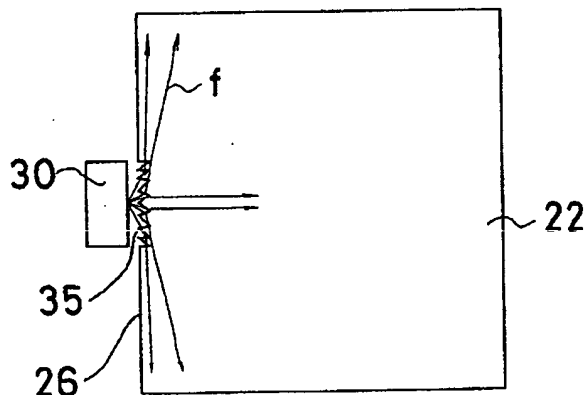
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(54) 【発明の名称】 面光源装置

(57) 【要約】

【課題】 点光源を用いた面光源装置の隅部分を明るくすることにより、輝度分布の均一化を図る。

【解決手段】 導光板22の光入射面にプリズムアレイ等からなる光学的パターン35を形成し、この光学的パターン35に対向させて発光部28(点光源30)を配置する。点光源30から出た光は、光学的パターン30に散乱され、導光板22の隅部分にも達し、隅部分の輝度を向上させる。



【特許請求の範囲】

【請求項1】 光入射面より導入された光を閉じ込めて光出射面から外部へ取り出すための導光板と、導光板の光入射面側に配置された、導光板の光入射面の幅と比較して小さな光源とを備えた面光源装置において、導光板の光入射面の、前記光源と対向する箇所に、光学的パターンを形成したことを特徴とする面光源装置。

【請求項2】 導光板の光入射面に設けた凹部に前記光源を納め、当該凹部の内面に光学的パターンを形成したことを特徴とする、請求項1に記載の面光源装置。

【請求項3】 光入射面より導入された光を閉じ込めて光出射面から外部へ取り出すための導光板と、導光板の光入射面側に配置された、導光板の光入射面の幅と比較して小さな光源とを備えた面光源装置において、導光板の光入射面に凹部を形成し、光源を当該凹部に配置するとともに、光源と凹部の間の空間の光出射面側及びその反対面側を光反射性の部材により覆ったことを特徴とする面光源装置。

【請求項4】 前記凹部を略半円形に形成し、前記光反射性の部材も略半円形に形成したことを特徴とする、請求項3に記載の面光源装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は面光源装置に関する。具体的にいうと、本発明は液晶表示装置や照明装置などに用いられる面光源装置に関する。

【0002】

【従来の技術】従来例の面光源装置1を図1の分解斜視図及び図2の断面図により示す。面光源装置1は、光を閉じ込めるための導光板2と発光部3と反射板4とから構成されている。導光板2はポリカーボネイト樹脂やメタクリル樹脂等の透明で屈折率の大きな樹脂により形成されており、導光板2の下面には凹凸加工や拡散反射インクのドット印刷等によって拡散パターン5が形成されている。発光部3は、回路基板6上に複数の発光ダイオード(LED)等のいわゆる点光源7を実装したものであって、導光板2の側面(光入射面8)に対向している。反射板4は、反射率の高い例えば白色樹脂シートによって形成されており、両面テープ9によって両側部を導光板2の下面に貼り付けられている。

【0003】しかし、図2に示すように、発光部3から出射されて光入射面8から導光板2の内部に導かれた光fは、導光板2内部で全反射することによって導光板2内部に閉じ込められる。導光板2内部の光fは拡散パターン5に入射すると拡散反射され、光出射面10へ向けて全反射の臨界角よりも小さな角度で反射された光fが光出射面10から外部へ取り出される。また、導光板2下面の拡散パターン5の存在しない箇所を透過した光fは、反射板4によって反射されて再び導光板2内部へ戻るため、導光板2下面からの光量損失を防止される。

【0004】

【発明が解決しようとする課題】点光源を用いた上記のような面光源装置1は、低消費電力化のため、点光源7で疑似的に線状光源化を図ったものであった。すなわち、点光源7を一列に配列することによって冷陰極線管のような線状光源を模したものである。従って、より低消費電力化を図るためには、点光源の数を減らして、好ましくは1つの点光源により高輝度で輝度ばらつきの少ない面光源装置を得ることが望まれる。

【0005】しかしながら、1つの点光源7で面光源装置1を光らせようとすると、図3に示すように、導光板2の光入射面側の隅部分11(図3で斜線を施した領域)が暗くなり、均一な輝度分布を得ることができなかった。

【0006】本発明は叙上の従来例の欠点を鑑みてなされたものであり、その目的とするところは、導光板の寸法に比較して小さな光源を用いた面光源装置において、光入射面側の隅部分が暗くなるのを防止し、輝度分布の均一化を図ることにある。

【0007】

【発明の開示】請求項1に記載の面光源装置は、光入射面より導入された光を閉じ込めて光出射面から外部へ取り出すための導光板と、導光板の光入射面側に配置された、導光板の光入射面の幅と比較して小さな光源とを備えた面光源装置において、導光板の光入射面の、前記光源と対向する箇所に、光学的パターンを形成したことを特徴としている。

【0008】この面光源装置にあつては、光入射面の光源と対向する箇所に光学的パターンを形成しているので、光源から出た光が導光板に入射する際、光学的パターンを通過することによって光が周囲に拡散される。従って、導光板の光入射面側の隅部分にも光が拡散され、当該隅部分が暗くなるのを防止することができる。従って、導光板に比較して小さな光源を用いる場合にも、面光源装置の輝度分布を均一化することができる。

【0009】請求項2に記載の実施態様は、請求項1記載の面光源装置において、導光板の光入射面に設けた凹部に前記光源を納め、当該凹部の内面に光学的パターンを形成したことを特徴としている。

【0010】請求項2に記載の実施態様にあつては、導光板の光入射面に凹部を設けて凹部内に光源を位置させているので、凹部から面光源の隅部分へ光が広がり易くなる。さらに、凹部の内面には光学的パターンが形成されているので、光学的パターンによって光が散乱されることにより、さらに光が導光板の隅部分へ広がり易くなる。よって、導光板に比較して小さな光源を用いる場合でも、導光板の隅部分をより明るくすることができ、面光源装置の輝度分布を均一化することができる。

【0011】請求項3に記載の面光源装置は、光入射面より導入された光を閉じ込めて光出射面から外部へ取り

出すための導光板と、導光板の光入射面側に配置された、導光板の光入射面の幅と比較して小さな光源とを備えた面光源装置において、導光板の光入射面に凹部を形成し、光源を当該凹部に配置するとともに、光源と凹部の間の空間の光出射面側及びその反対面側を光反射性の部材により覆ったことを特徴としている。

【0012】また、請求項4に記載の実施態様は、請求項3記載の面光源装置において、前記凹部を略半円形に形成し、前記光反射性の部材も略半円形に形成したことを特徴としている。

【0013】請求項3及び4に記載の面光源装置においては、導光板の光入射面に設けた凹部に光源を配置しているので、光源から出た光は凹部から導光板へ広い範囲にわたって入射する。従って、導光板の光入射面側の隅部分にも光が拡散され、当該隅部分が暗くなるのを防止することができる。従って、導光板に比較して小さな光源を用いる場合にも、面光源装置の輝度分布を均一化することができる。

【0014】また、光源と凹部の間の空間の光出射面側及びその反対面側を光反射性の部材により覆っているから、光源から出射された光が導光板に入射することなく、光源と導光板の隙間から上方もしくは下方へ逃げるのを防止することができ、光の結合効率を向上させ、面光源装置の輝度を高くできる。

【0015】特に、請求項4に記載の面光源装置のように、凹部及び光反射性の部材を略反円形状に形成することにより光源からの光を各方向に均等に広げさせることができ、輝度分布をより均一化することができる。

【0016】

【発明の実施の形態】図4は本発明の一実施形態による面光源装置21を示す分解斜視図である。屈折率の大きな透明樹脂材料によって形成されている導光板22の上面が光出射面23となっており、下面には凹凸加工や拡散反射インクのドット印刷等によって拡散パターン24が形成されている。この導光板22の下面両側部には、溝状をした反射板保持部25が設けられており、導光板22の光入射面26と反対側の端面には、下方へ向けてストッパー27が垂下されている。

【0017】発光部28は、白色樹脂等の表面反射率の高い材質からなる外装部材29によって点光源30、すなわち導光板22に比べて小さな光源を包んだものである。例えば、樹脂モールド型発光ダイオードのような発光素子（点光源30）を外装部材29で包んだものである。この点光源30は光出射側の面だけが外装部材29から露出している。しかし、点光源30から背面方向や側面方向へ出射された光は、外装部材29の内面で反射され、点光源30の光は前面のみから効率よく出射される。なお、豆電球などの点光源30を白色樹脂等からなる外装部材29内に納めて発光部28を形成してもよい。

【0018】反射板31は表面反射率の高い材料によって形成されており、例えば硬質もしくは比較的軟質の白色プラスチックシートによって形成されている。この反射板31は、光入射面26側から反射板保持部25に差し込んでストッパー27に当てることにより、導光板22下面に保持される。

【0019】また、導光板22の光入射面26からは一対の弾性片32が一体成形されており、両弾性片32の先端部内面には係合爪33が突出している。一方、外装部材29の両側面には、弾性片32がびったりと納まるような側面溝34が凹設されている。しかし、発光部28は弾性片32を側面溝34に納めるようにして弾性片32間に挟持されており、弾性片32の係合爪33を背面に係合することによって脱落しないよう保持されている。

【0020】光入射面26の発光部28と対向する位置、すなわち弾性片32間の部分には、多数のプリズムからなるプリズムアレイ状の光学的パターン35が形成されている。

【0021】図5は導光板22の下面に設けられた拡散パターン24を示す平面図である。この拡散パターン24は多数の拡散パターン素子24aからなり、拡散パターン素子24aは、点光源30を中心として導光板22の下面全面に同心円状に配置されている。また、拡散パターン素子24aはランダムに配置されており、各拡散パターン素子24aどうしは点光源30からの距離が遠くなるにつれてピッチが短くなっており、点光源30から離れるに従って拡散パターン密度が次第に大きくなっている。

【0022】しかし、プリズムアレイ状の光学的パターン35に対向して配置された発光部28から出射された光fは、前方に偏って導光板22内に導入されることがなく、図6に示すように、光学的パターン35を構成する各プリズムで屈折することによって広い範囲にわたって導光板22内部へ導かれる。従って、光入射面26の両側の隅部分にも光が到達し、当該隅部分が明るくなって面光源装置21の輝度分布が均一化される。さらに、導光板22の下面には、図5に示したような拡散パターン24が形成されているので、発光部28から導光板22へ入射した光は、導光板22の各領域で均等に射出され、導光板22の全面で均等な輝度分布を得ることができる。

【0023】なお、上記光学的パターン35としては、点光源30から入射してきた光を両側へ散らばせることができるようなものであればよく、特に限定されるものではない。例えば、図7に示すような略凹面状のレンズ部分からなるレンズアレイ状の光学的パターン35でもよく、しば加工などでもよい。

【0024】（第2の実施形態）図8は本発明の別な実施形態による面光源装置41を示す平面図である。この

面光源装置41にあっては、導光板22の光入射面26に凹部42を設け、当該凹部42の奥に光学的パターン35を形成している。発光部28からは全面及び両側面に光を出射するようになっている。

【0025】従って、発光部28から両側方へ出射された光fは、凹部42の側面から導光板22に入射して隅部分に達する。また、発光部28から前方へ出射された光fは、凹部42の前面から導光板22に入射し、光学的パターン35で拡散されて導光板22の全体に広がる。従って、この面光源装置41にあっては、導光板22の隅部分が暗くなることなく、面光源装置41の輝度分布を均一化することができる。

【0026】(第3の実施形態)図9は本発明のさらに別な実施形態による面光源装置43を示す分解斜視図である。この面光源装置43にあっては、導光板22の光入射面26側の端部中央部に略半円形をした凹部44を設けてある。一方、発光部28は、発光ダイオード等の発光素子チップ45を透明樹脂46で封止した点光源30(発光素子)を、表面反射率の大きな白色樹脂等からなる外装部材29内に埋め込んだものである。この外装部材29の前面には、導光板22の凹部44に合致する形状の突部47が突出しており、突部47の上下方向中央部には、突部47全幅にわたってスリット48が開口されており、スリット48を通して点光源30が露出している。図11に示すように、スリット48の開口高さは、点光源30の高さよりも狭くなっている。

【0027】しかして、点光源30から出射された光fは、白色樹脂等からなる外装部材29で反射されることによって外装部材29内に閉じ込められてスリット48からのみ外部へ出射される。しかも、スリット48の開口高さは点光源30の高さよりも小さくなっているのので、光の結合効率が向上する。

【0028】また、図10に示すように、発光部28のスリット48を通して略180°の角度で放射された光fは、導光板22の凹部44内面から導光板22内部に導かれる。よって、光fは導光板22の全体に広がり、特に導光板22の隅部分にも達して隅部分の輝度を高くすることができ、面光源装置43の輝度分布を均一化することができる。

【0029】(照明装置)図12は本発明にかかる面光源装置を利用した照明装置71を示す分解斜視図である。この照明装置71においては、光量を大きくして輝度を高くするため、4つの発光部28を用いて導光板22の略半円形をした凹部44にはめ込んでいる。この照明装置71は室内照明用や自動車のテールランプなどに用いられるものである。

【0030】(液晶表示装置)図13は本発明にかかる面光源装置80を用いた液晶表示装置81を示す分解斜視図である。この面光源装置80にあっては、導光板22の光入射面26に赤(R)、緑(G)、青(B)の3

色の点光源30(発光部)が設けられている。面光源装置80の前面には、拡散反射シート82が配置され、その前面に液晶表示パネル83が配設されている。液晶表示パネル83は、透明電極やTFT、カラーフィルタ、ブラックマトリクス等を形成された2枚の液晶基板(ガラス基板、フィルム基板)84、85間に液晶材料を封止し、液晶基板84、85の両外面に偏光板86を配設したものである。

【0031】このような液晶表示装置81によれば、表示面の輝度分布が均一にすることができ、液晶表示装置81の高品質化を図ることができる。

【0032】(液晶表示装置を備えた電子装置)本発明にかかる液晶表示装置は、携帯電話や弱電力無線機のような無線情報伝達装置、携帯用パソコン、電子手帳や電卓のような情報処理装置などに用いるのに好ましい。図14は本発明にかかる例えば図13に示したような液晶表示装置81をディスプレイ用に備えた携帯電話89を示す斜視図、図15はその機能ブロック図である。携帯電話89の正面にはダイヤル入力用のテンキー等のボタンスイッチ90を備え、その上方に液晶表示装置81が配設され、上面にアンテナ91が設けられている。しかして、ボタンスイッチ90からダイヤル等を入力すると、入力されたダイヤル情報等が送信回路92を通じてアンテナ91から電話会社の基地局へ送信される。一方、入力されたダイヤル情報等は液晶駆動回路93へ送られ、液晶表示装置81が液晶駆動回路93により駆動されてダイヤル情報等が液晶表示装置81に表示される。

【0033】また、図16は本発明にかかる例えば図13に示したような液晶表示装置81をディスプレイ用に備えた電子手帳94を示す斜視図、図17はその機能ブロック図である。電子手帳94は、カバー95を開くと、キー入力部96と液晶表示装置81を備えており、内部には液晶駆動回路93や演算処理回路97等が設けられている。しかして、例えばキー入力部96からテンキーやカナキー等を入力すると、入力情報が液晶駆動回路93に送られて液晶表示装置81に表示される。ついで、演算キー等の制御キーを押すと、演算処理回路97で所定の処理や演算が実行され、その結果が液晶駆動回路93に送られて液晶表示装置81に表示される。

【図面の簡単な説明】

【図1】点光源を用いた従来の面光源装置を示す分解斜視図である。

【図2】同上の面光源装置の断面図である。

【図3】同上の面光源装置における輝度分布のばらつきを示す平面図である。

【図4】本発明の一実施形態による面光源装置を示す分解斜視図である。

【図5】同上の面光源装置の拡散パターンを示す平面図である。

【図6】同上の面光源装置における光学的パターンの作用説明図である。

【図7】別な光学的パターンの形状を示す平面図である。

【図8】本発明の別な実施形態による面光源装置を示す平面図である。

【図9】本発明のさらに別な実施形態による面光源装置を示す分解斜視図である。

【図10】同上の面光源装置の作用説明図である。

【図11】同上の面光源装置の作用説明図である。

【図12】本発明の面光源装置を用いた照明装置の分解斜視図である。

【図13】本発明の面光源装置を用いた液晶表示装置の分解斜視図である。

【図14】本発明にかかる液晶表示装置をディスプレイ用に備えた携帯電話を示す斜視図である。

【図15】同上の携帯電話において液晶表示装置を駆動するための構成を示すブロック図である。

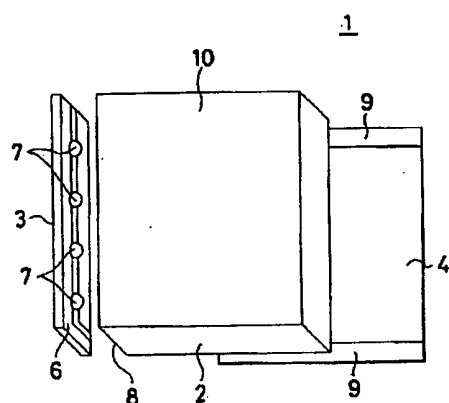
【図16】本発明にかかる液晶表示装置をディスプレイ用に備えた電子手帳を示す斜視図である。

【図17】同上の電子手帳において液晶表示装置を駆動するための構成を示すブロック図である。

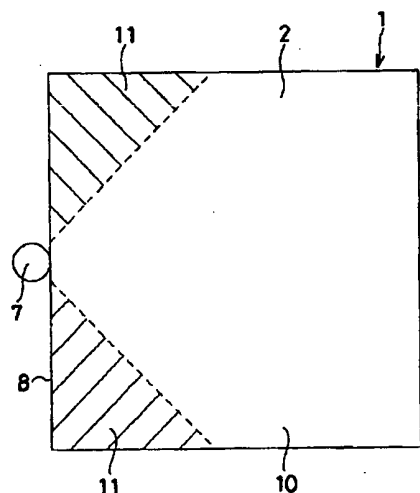
【符号の説明】

- 22 導光板
- 23 光出射面
- 26 光入射面
- 30 点光源
- 35 光学的パターン
- 42 凹部
- 44 凹部
- 47 突部
- 48 スリット

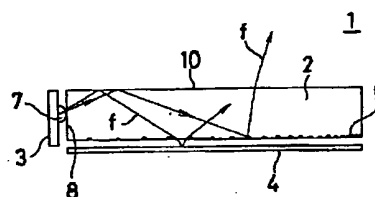
【図1】



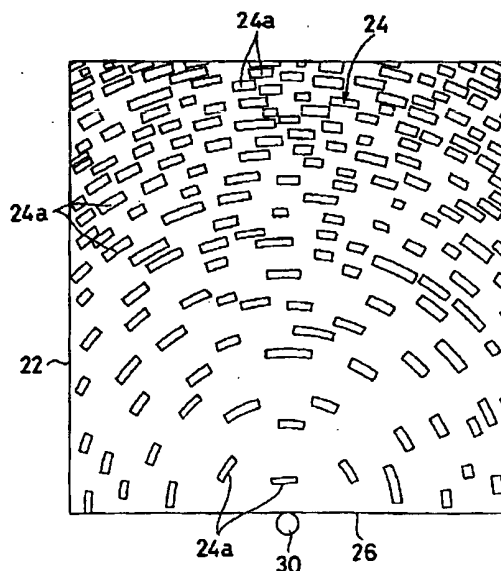
【図3】



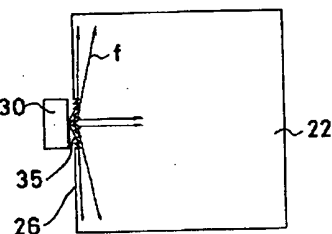
【図2】



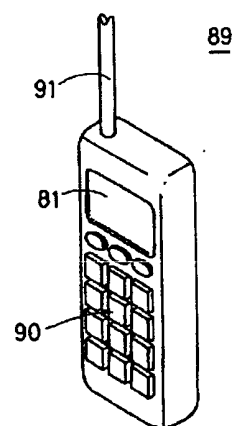
【図5】



【図6】

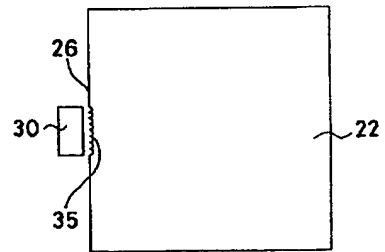


【図14】

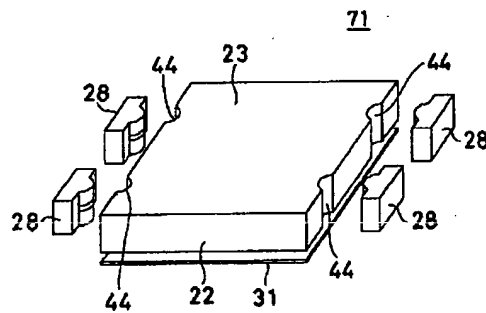
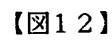
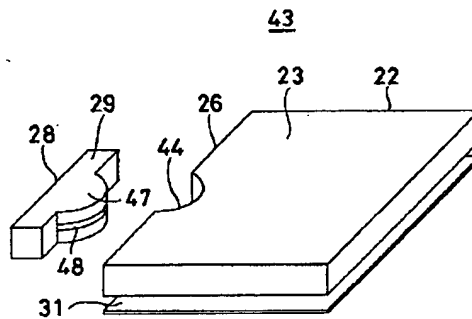


89

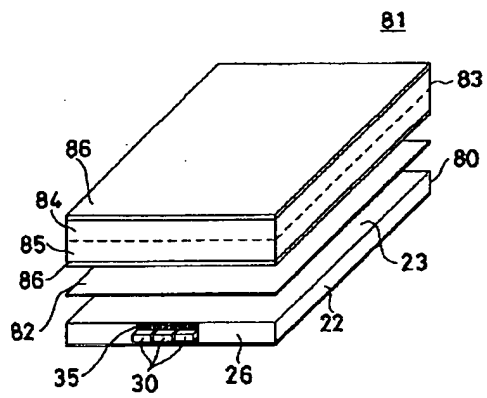
【図7】



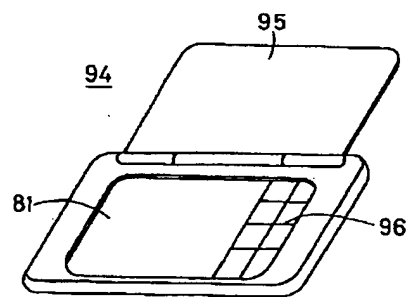
【図9】



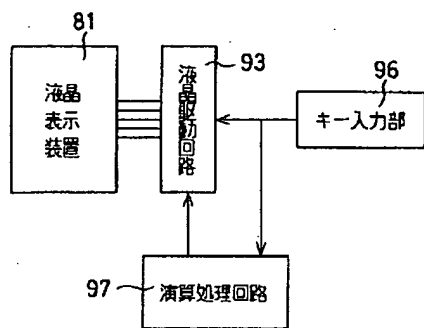
【図13】



【図16】



【図17】



PATENT ABSTRACTS OF JAPAN

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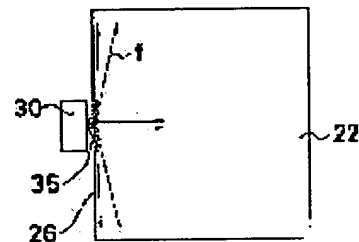
(22)Date of filing : 14.01.1997 (72)Inventor : SHINOHARA MASAYUKI
AOYAMA SHIGERU

(54) SURFACE LIGHT SOURCE DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent the darkening of corner portions of a light incident face for a surface light source device using a comparatively small light source compared with the dimension of a light guide panel and make brightness distribution uniform by forming an optical pattern at an opposite place to the light source for the light incident face of the light guide panel which shuts in light led-in from the light incident face and extracts the light outward from a light emission face.

SOLUTION: A light (f) emitted from a light emitting section opposed to an optical pattern 35 of a prism array state is not led into the light guide panel due to forward deflected light. The light is led to the inside of the light guide panel 22 in a wide range by refraction through each prism that constitutes the optical pattern 35. The light reaches even the corner portions of both sides of the light incident face 26 and the brightness distribution of the surface light source device is made uniform when the corner portions becomes bright. The light incident on the light guide panel 22 from the light emitting section is uniformly emitted at each region of the light guide panel 22 and uniform brightness distribution is obtained in the whole surface of the light guide panel 22 since a diffused pattern is formed at the bottom face of the light guide panel 22.



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CLAIMS

[Claim(s)]

[Claim 1] Surface light source equipment characterized by forming an optical pattern in the part which has been arranged at the optical plane-of-incidence side of the light guide plate for shutting up the light introduced from optical plane of incidence, and taking out to the optical outgoing radiation side shell exterior, and a light guide plate, and which counters in the surface light source equipment equipped with the small light source as compared with the width of face of the optical plane of incidence of a light guide plate with the aforementioned light source of the optical plane of incidence of a light guide plate.

[Claim 2] Surface light source equipment according to claim 1 which dedicates the aforementioned light source to the crevice established in the optical plane of incidence of a light guide plate, and is characterized by forming an optical pattern in the inside of the crevice concerned.

[Claim 3] The light guide plate for shutting up the light introduced from optical plane of incidence, and taking out to the optical outgoing radiation side shell exterior. It compares with the width of face of the optical plane of incidence of a light guide plate arranged at the optical plane-of-incidence side of a light guide plate, and is the small light source. It is surface light source equipment equipped with the above, and while forming a crevice in the optical plane of incidence of a light guide plate and arranging the light source to the crevice concerned, it is characterized by covering its optical outgoing radiation side [of the space between the light source and a crevice], and opposite side side by the member of light reflex nature.

[Claim 4] Surface light source equipment according to claim 3 characterized by having formed the aforementioned crevice in the abbreviation semicircle and forming the member of the aforementioned light reflex nature in an abbreviation semicircle.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to surface light source equipment. Speaking concretely, this invention's relating to the surface light source equipment used for a liquid crystal display, a lighting system, etc.

[0002]

[Description of the Prior Art] The decomposition perspective diagram of drawing 1 and the cross section of drawing 2 show the surface light source equipment 1 of the conventional example. Surface light source equipment 1 consists of the light guide plates 2, the light-emitting parts 3, and reflecting plates 4 for shutting up light. The light guide plate 2 is fabricated by transparence, such as polycarbonate resin and methacrylic resin, with the resin with a big refractive index, and the diffusion pattern 5 is formed in the inferior surface of tongue of a light guide plate 2 of concavo-convex processing, dot printing of diffuse reflection ink, etc. The light-emitting part 3 mounted the so-called point light sources 7, such as two or more light emitting diodes (Light Emitting Diode), on the circuit board 6, and has countered the side (optical plane of incidence 8) of a light guide plate 2. The reflecting plate 4 is formed for example, with the white resin sheet with a high reflection factor, and

the both-sides section is stuck on it by the double-sided tape 9 on the inferior surface of tongue of a light guide plate 2.

[0003] A deer is carried out, and as shown in drawing 2, the light f which outgoing radiation was carried out from the light-emitting part 3, and was led to the interior of a light guide plate 2 from the optical plane of incidence 8 is confined in the light guide plate 2 interior by carrying out total reflection in the light guide plate 2 interior. If incidence of the light f of the light guide plate 2 interior is carried out to the diffusion pattern 5, diffuse reflection of it will be carried out, and the light f reflected at the angle smaller than the critical angle of total reflection towards the optical outgoing radiation side 10 is taken out in the optical outgoing radiation side 10 shell exterior. Moreover, since it is reflected by the reflecting plate 4 and the light f which penetrated the part where the diffusion pattern 5 of light guide plate 2 inferior surface of tongue does not exist returns to the light guide plate 2 interior again, the quantity of light loss from light guide plate 2 inferior surface of tongue is prevented.

[0004]

[Problem(s) to be Solved by the Invention] the above surface light source equipments 1 using the point light source — a low-power-izing sake — the point light source 7 — false — like — a line — light source-ization was attained namely, the thing for which the point light source 7 is arranged to a single tier — a line like a cold cathode-ray tube — the light source is imitated Therefore, in order to attain low-power-ization more, to reduce the number of the point light sources and to obtain surface light source equipment with little brightness dispersion by high brightness by the one point light source preferably is desired.

[0005] However, when it was going to shine surface light source equipment 1 by the one point light source 7, as shown in drawing 3, the amount of [by the side of the optical plane of incidence of a light guide plate 2 / 11 (field which gave the slash by drawing 3)] corner was not able to become dark, and it was not able to obtain uniform luminance distribution.

[0006] this invention is made in view of the fault of the conventional example on **, the amount of [by the side of optical plane of incidence] corner prevents becoming dark in the surface light source equipment using the small light source as compared with the size of a light guide plate the place made into the purpose, and it is shown in attaining equalization of luminance distribution.

[0007]

[Description of the Invention] Surface light source equipment according to claim 1 is characterized by forming an optical pattern in the part which has been arranged at the optical plane-of-incidence side of the light guide plate for shutting up the light introduced from optical plane of incidence, and taking out to the optical outgoing radiation side shell exterior, and a light guide plate and which counters in the surface light source equipment equipped with the small light source as compared with the width of face of the optical plane of incidence of a light guide plate with the aforementioned light source of the optical plane of incidence of a light guide plate.

[0008] If it is in this surface light source equipment, since the optical pattern is formed in the light source of optical plane of incidence, and the part which counters, in case the light which came out of the light source carries out incidence to a light guide plate, light diffuses around by passing an optical pattern. Therefore, light diffuses also in a part for the corner by the side of the optical plane of incidence of a light guide plate, and it can prevent that the amount of corner concerned becomes dark. Therefore, when using the small light source as compared with a light guide plate, the luminance distribution of surface light source equipment can be equalized.

[0009] In surface light source equipment according to claim 1, an embodiment according to claim 2 dedicates the aforementioned light source to the crevice established in the optical plane of incidence of a light guide plate, and is characterized by forming an optical pattern in the inside of the crevice concerned.

[0010] If it is in an embodiment according to claim 2, since it establishes a crevice in the optical plane of incidence of a light guide plate and the light source is located in a crevice, light becomes easy to spread to a part for the corner of the surface light source from a crevice. Furthermore, since the optical pattern is formed in the inside of a crevice, when light is scattered about with an optical pattern, light further becomes easy to spread to a part for the corner of a light guide plate. Therefore, even when using the small light source as compared with a light guide plate, a part for the corner of a light guide plate can be made brighter, and the luminance distribution of surface light source equipment can be equalized.

[0011] The light guide plate for surface light source equipment according to claim 3 shutting up the light introduced from optical plane of incidence, and taking out to the optical outgoing radiation side shell exterior, While forming a crevice in the optical plane of incidence of a light guide plate and arranging the light source to the crevice concerned in the surface light source equipment which has been arranged at the optical plane-of-incidence side of a light guide plate and which was equipped with the small light source as compared with the width of face of the optical plane of incidence of a light guide plate It is characterized by covering its optical outgoing radiation side [of the space between the light source and a crevice], and opposite side side by the member of light reflex nature.

[0012] Moreover, the embodiment according to claim 4 is characterized by having formed the aforementioned crevice in the abbreviation semicircle and forming the member of the aforementioned light reflex nature in an abbreviation semicircle in surface light source equipment according to claim 3.

[0013] If it is in surface light source equipment given in claims 3 and 4, since the light source is arranged to the crevice established in the optical plane of incidence of a light guide plate, incidence of the light which came out of the light source is carried out from a crevice over the latus range to a light guide plate. Therefore, light diffuses also in a part for the corner by the side of the optical plane of incidence of a light guide plate, and it can prevent that the amount of corner concerned becomes dark. Therefore, when using the small light source as compared with a light guide plate, the luminance distribution of surface light source equipment can be equalized.

[0014] Moreover, without the light by which outgoing radiation was carried out from the light source carrying out incidence to a light guide plate, since its optical outgoing radiation side [of the space between the light source and a crevice] and opposite side side is covered by the member of light reflex nature, it can prevent escaping from the crevice between the light source and a light guide plate to the upper part or a lower part, the joint efficiency of light is raised, and the brightness of surface light source equipment can be made high.

[0015] Especially, like surface light source equipment according to claim 4, by forming the member of a crevice and light reflex nature in the shape of **** circular, the light from the light source can be equally spread in each direction, and luminance distribution can be equalized more.

[0016]

[Embodiments of the Invention] Drawing 4 is the decomposition perspective diagram showing the surface light source equipment 21 by 1 operation gestalt of this invention. The upper surface of the light guide plate 22 currently formed of transparent resin material with a big refractive index is the optical outgoing radiation side 23, and the diffusion pattern 24 is formed in the inferior surface of

tongue of concavo-convex processing, dot printing of diffuse reflection ink, etc. The reflecting plate attaching part 25 which carried out the shape of a slot is formed in the inferior-surface-of-tongue both-sides section of this light guide plate 22, and the stopper 27 has hung towards the lower part to the optical plane of incidence 26 of a light guide plate 22, and the end face of an opposite side.

[0017] sheathing which a light-emitting part 28 becomes from the quality of the material with high surface reflection factors, such as a white resin, — compared with the point light source 30 22, i.e., a light guide plate, the small light source is wrapped by the member 29 for example, a light emitting device (point light source 30) like resin mould type light emitting diode — sheathing — it wraps in a member 29 this point light source 30 — the field by the side of optical outgoing radiation — sheathing — it has exposed from the member 29 the light by which carried out the deer and outgoing radiation was carried out in the direction of a tooth back, or the direction of the side from the point light source 30 — sheathing — it is reflected by the inside of a member 29 and outgoing radiation of the light of the point light source 30 is efficiently carried out only from a front face in addition, sheathing which consists the point light source 30 of a miniature bulb etc. of a white resin etc. — it may dedicate in a member 29 and a light-emitting part 28 may be formed

[0018] The reflecting plate 31 is formed of material with a high surface reflection factor, for example, is formed with the hard or comparatively elastic white sheet plastic. This reflecting plate 31 is held on the light guide plate 22 inferior surface of tongue by inserting in the reflecting plate attaching part 25 from the optical plane-of-incidence 26 side, and calling on a stopper 27.

[0019] Moreover, from the optical plane of incidence 26 of a light guide plate 22, the elastic piece 32 of a couple is really fabricated and the engagement presser foot stitch tongue 33 has projected to the point inside of both the elastic piece 32. on the other hand — sheathing — the side slot 34 where the elastic piece 32 is settled exactly is cut in the both-sides side of a member 29 A deer is carried out, and as a light-emitting part 28 dedicates the elastic piece 32 to the side slot 34, it is pinched between the elastic pieces 32, and it is held so that it may not drop out by engaging the engagement presser foot stitch tongue 33 of the elastic piece 32 with a tooth back.

[0020] The optical pattern 35 of the shape of a prism array which consists of many prism is formed in the portion between the light-emitting part 28 of the optical plane of incidence 26 and the position 32 which counters, i.e., an elastic piece.

[0021] Drawing 5 is the plan showing the diffusion pattern 24 prepared in the inferior surface of tongue of a light guide plate 22. This diffusion pattern 24 consists of much diffusion pattern element 24a, and diffusion pattern element 24a is arranged in the shape of a concentric circle all over the inferior surface of tongue of a light guide plate 22 focusing on the point light source 30. Moreover, diffusion pattern density is becoming large gradually as diffusion pattern element 24a is arranged at random, as for each diffusion pattern element 24a, the pitch is short as the distance from the point light source 30 becomes far, and it separates from the point light source 30.

[0022] The light f by which carried out the deer and outgoing radiation was carried out from the light-emitting part 28 which countered the optical prism array-like pattern 35 and has been arranged is led to the light guide plate 22 interior over the latus range by being refracted by each prism which constitutes the optical pattern 35, as it inclines ahead, and is not introduced in a light guide plate 22 and it is shown in drawing 6 . Therefore, light also reaches a part for the corner of the both sides of the optical plane of incidence 26, the amount of corner concerned becomes bright, and the luminance distribution of surface light source equipment 21 is equalized. Furthermore, since the diffusion pattern 24 as shown in drawing 5 is formed in the inferior surface of tongue of a light guide plate 22, outgoing radiation of the light which carried out incidence from the light-emitting part 28 to the light guide

plate 22 is equally carried out in each field of a light guide plate 22, and it can obtain equal luminance distribution all over a light guide plate 22.

[0023] In addition, it is not limited especially that what is necessary is just that in which the light which has carried out incidence from the point light source 30 can be scattered to both sides as the above-mentioned optical pattern 35. For example, the optical pattern 35 of the shape of a lens array which consists of a lens portion of the shape of an abbreviation concave surface as shown in drawing 7 is sufficient, and crimp processing etc. is sufficient.

[0024] (2nd operation gestalt) Drawing 8 is the plan showing the surface light source equipment 41 by another operation gestalt of this invention. If it is in this surface light source equipment 41, a crevice 42 is established in the optical plane of incidence 26 of a light guide plate 22, and the optical pattern 35 is formed in the inner part of the crevice 42 concerned. From a light-emitting part 28, outgoing radiation of the light is carried out to the whole surface and a both-sides side.

[0025] Therefore, incidence of the light f by which outgoing radiation was carried out from the light-emitting part 28 to the method of both sides is carried out to a light guide plate 22 from the side of a crevice 42, and it reaches a part for a corner. Moreover, incidence of the light f by which outgoing radiation was carried out from the light-emitting part 28 to the front is carried out to a light guide plate 22 from the front face of a crevice 42, it is diffused by the optical pattern 35, and spreads in the whole light guide plate 22. Therefore, even if it is in this surface light source equipment 41, there is no bird clapper darkly [the amount of / of a light guide plate 22 / corner], and the luminance distribution of surface light source equipment 41 can be equalized.

[0026] (3rd operation gestalt) Drawing 9 is the decomposition perspective diagram showing the surface light source equipment 43 by still more nearly another operation gestalt of this invention. If it is in this surface light source equipment 43, the crevice 44 which carried out the abbreviation semicircle is established in the edge center section by the side of the optical plane of incidence 26 of a light guide plate 22. Sheathing which a light-emitting part 28 becomes from a white resin with a big surface reflection factor etc. on the other hand about the point light source 30 (light emitting device) which closed the light-emitting-device chips 45, such as light emitting diode, by the transparent resin 46 — it embeds in a member 29 this sheathing — the projected part 47 of the configuration corresponding to the crevice 44 of a light guide plate 22 has projected, opening of the slit 48 is carried out to the vertical direction center section of the projected part 47 covering projected part 47 full one, and the point light source 30 is exposed to the front face of a member 29 through a slit 48. As shown in drawing 11, the opening height of a slit 48 is narrower than the height of the point light source 30.

[0027] sheathing which the light f by which carried out the deer and outgoing radiation was carried out from the point light source 30 becomes from a white resin etc. — being reflected by the member 29 — sheathing — it is shut up in a member 29 and outgoing radiation is carried out only from a slit 48 outside. And since the opening height of a slit 48 is smaller than the height of the point light source 30, the joint efficiency of light improves.

[0028] Moreover, as shown in drawing 10, the light f emitted at the angle of 180 degrees of abbreviation through the slit 48 of a light-emitting part 28 is led to the light guide plate 22 interior from crevice 44 inside of a light guide plate 22. Therefore, Light f spreads in the whole light guide plate 22, especially can be given also to a part for the corner of a light guide plate 22, can make the brightness for a corner high, and can equalize the luminance distribution of surface light source equipment 43.

[0029] (Lighting system) Drawing 12 is the decomposition perspective diagram showing the lighting system 71 using the surface light source equipment concerning this invention. In this lighting system 71, in order to enlarge the quantity of light and to make brightness high, it has inserted in the crevice 44 which carried out the abbreviation semicircle of a light guide plate 22 using four light-emitting parts 28. This lighting system 71 is used for the object for indoor lighting, the tail lamp of an automobile, etc.

[0030] (Liquid crystal display) Drawing 13 is the decomposition perspective diagram showing the liquid crystal display 81 using the surface light source equipment 80 concerning this invention. If it is in this surface light source equipment 80, the point light source 30 (light-emitting part) of three colors of red (R), green (G), and blue (B) is formed in the optical plane of incidence 26 of a light guide plate 22. The diffuse reflection sheet 82 is arranged in the front face of surface light source equipment 80, and the liquid crystal display panel 83 is arranged in the front face. The liquid crystal display panel 83 closes liquid crystal material between two liquid crystal substrates (a glass substrate, film substrate) 84 which had a transparent electrode, TFT, the light filter, the black matrix, etc. formed, and 85, and arranges a polarizing plate 86 in both the superficies of the liquid crystal substrates 84 and 85.

[0031] According to such a liquid crystal display 81, the luminance distribution of the screen can make it uniform and can attain quality improvement of a liquid crystal display 81.

[0032] (Electronic instrument equipped with the liquid crystal display) The liquid crystal display concerning this invention is desirable although used for a radio data transmission unit like a cellular phone or a weak-electric-current force walkie-talkie, a portable personal computer, an electronic notebook, an information processor like a calculator, etc. The perspective diagram and drawing 15 which show the cellular phone 89 which equipped the display with the liquid crystal display 81 which drawing 14 requires for this invention as shown, for example in drawing 13 are the functional block diagram. The transverse plane of a cellular phone 89 is equipped with the button switches 90, such as a ten key for a dial input, a liquid crystal display 81 is arranged in the upper part, and the antenna 91 is formed in the upper surface. If a deer is carried out and a dial etc. is inputted from a button switch 90, the inputted dial information will be transmitted to the base station of the telephone company from an antenna 91 through a sending circuit 92. On the other hand, the inputted dial information is sent to the liquid crystal drive circuit 93, a liquid crystal display 81 drives by the liquid crystal drive circuit 93, and dial information etc. is displayed on a liquid crystal display 81.

[0033] Moreover, the perspective diagram and drawing 17 which show the electronic notebook 94 which equipped the display with the liquid crystal display 81 which drawing 16 requires for this invention as shown, for example in drawing 13 are the functional block diagram. If an electronic notebook 94 opens covering 95, it has the key input section 96 and the liquid crystal display 81, and the liquid crystal drive circuit 93 and the data-processing circuit 97 grade are prepared in the interior. If a deer is carried out, for example, a ten key, a kana key, etc. are inputted from the key input section 96, input will be sent to the liquid crystal drive circuit 93, and will be displayed on a liquid crystal display 81. Subsequently, if control keys, such as an operator key, are pushed, processing and an operation predetermined in the data-processing circuit 97 are performed, and the result will be sent to the liquid crystal drive circuit 93, and will be displayed on a liquid crystal display 81.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the decomposition perspective diagram showing the conventional surface light

source equipment using the point light source.

[Drawing 2] It is the cross section of surface light source equipment same as the above.

[Drawing 3] It is the plan showing dispersion in the luminance distribution in surface light source equipment same as the above.

[Drawing 4] It is the decomposition perspective diagram showing the surface light source equipment by 1 operation form of this invention.

[Drawing 5] It is the plan showing the diffusion pattern of surface light source equipment same as the above.

[Drawing 6] It is operation explanatory drawing of the optical pattern in surface light source equipment same as the above.

[Drawing 7] It is the plan showing the configuration of another optical pattern.

[Drawing 8] It is the plan showing the surface light source equipment by another operation form of this invention.

[Drawing 9] It is the decomposition perspective diagram showing the surface light source equipment by still more nearly another operation form of this invention.

[Drawing 10] It is operation explanatory drawing of surface light source equipment same as the above.

[Drawing 11] It is operation explanatory drawing of surface light source equipment same as the above.

[Drawing 12] It is the decomposition perspective diagram of the lighting system using the surface light source equipment of this invention.

[Drawing 13] It is the decomposition perspective diagram of the liquid crystal display using the surface light source equipment of this invention.

[Drawing 14] It is the perspective diagram showing the cellular phone which equipped the display with the liquid crystal display concerning this invention.

[Drawing 15] It is the block diagram showing the composition for driving a liquid crystal display in a cellular phone same as the above.

[Drawing 16] It is the perspective diagram showing the electronic notebook which equipped the display with the liquid crystal display concerning this invention.

[Drawing 17] It is the block diagram showing the composition for driving a liquid crystal display in an electronic notebook same as the above.

[Description of Notations]

22 Light Guide Plate

23 Optical Outgoing Radiation Side

26 Optical Plane of Incidence

30 Point Light Source

35 Optical Pattern

42 Crevice

44 Crevice

47 Projected Part

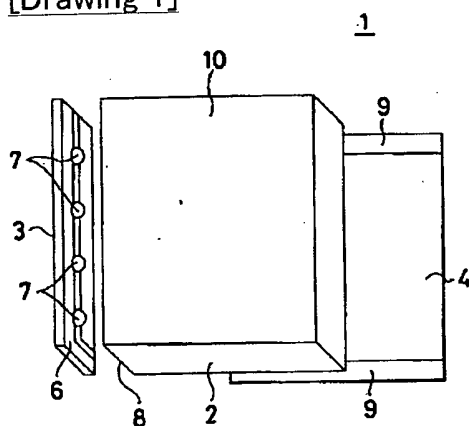
48 Slit

Japan Patent Office is not responsible for any damages caused by the use of this translation.

2.**** shows the word which can not be translated.

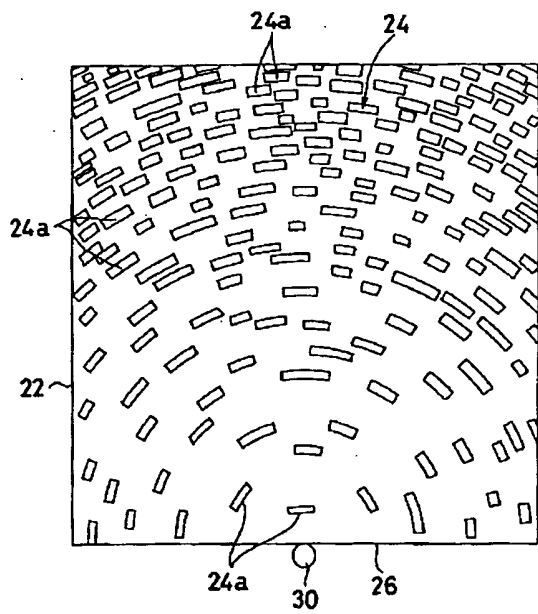
3. In the drawings, any words are not translated.

[Drawing 1]

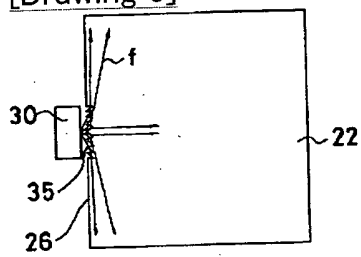


Drawing C is a schematic diagram of a square frame. The top horizontal edge is labeled 11, the right vertical edge is labeled 2, the bottom horizontal edge is labeled 10, and the left vertical edge is labeled 11. A dashed diagonal line runs from the top-left corner to the bottom-right corner. The triangular region in the top-left corner, bounded by the left edge, the top edge, and the dashed diagonal, is filled with diagonal hatching and labeled 7. The triangular region in the bottom-left corner, bounded by the left edge, the bottom edge, and the dashed diagonal, is also filled with diagonal hatching and labeled 8. A small circle is located on the left vertical edge, between the two hatched regions, and is labeled 7.

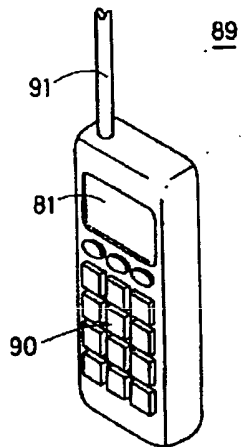
[Drawing 5]



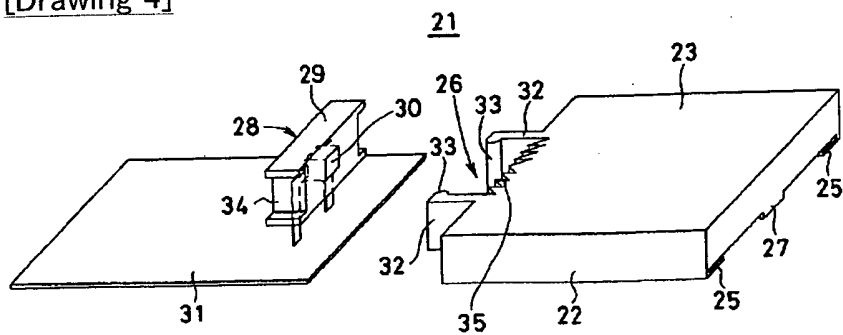
[Drawing 6]



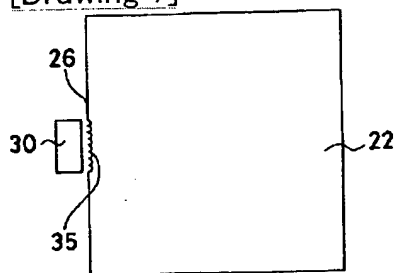
[Drawing 14]



[Drawing 4]

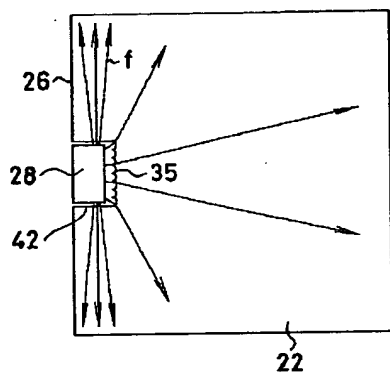


[Drawing 7]



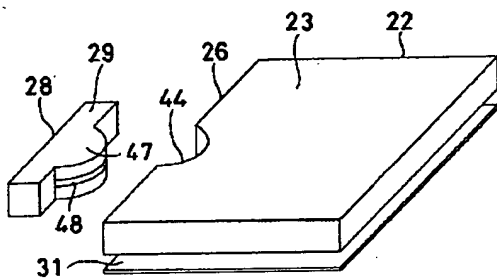
[Drawing 8]

41

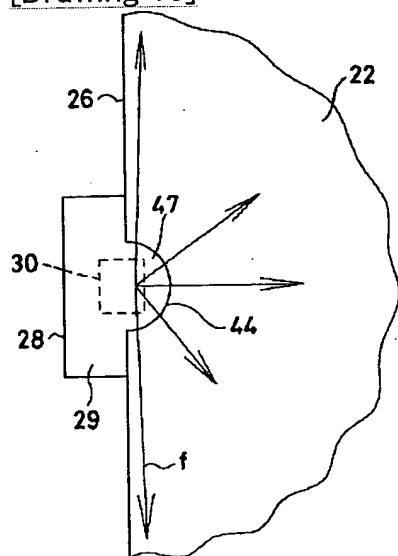


[Drawing 9]

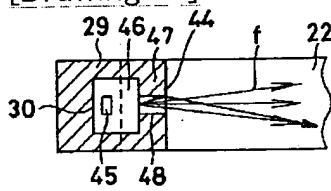
43



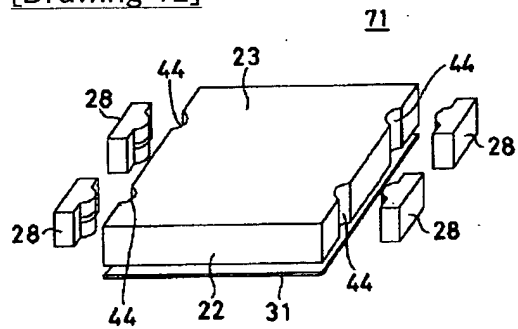
[Drawing 10]



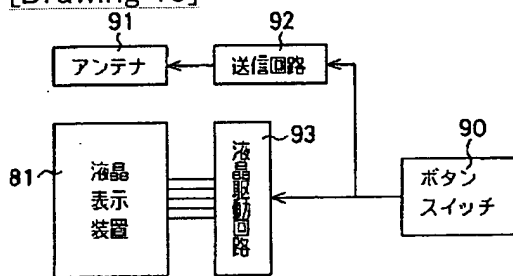
[Drawing 11]



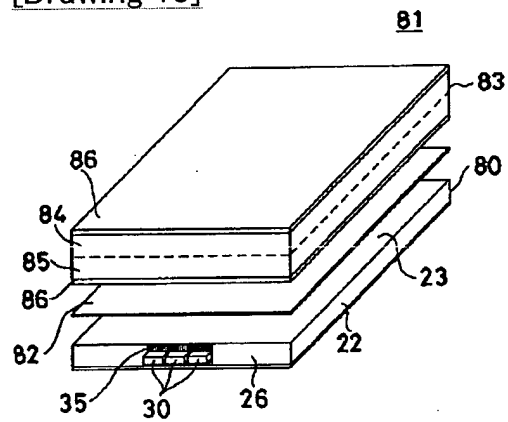
[Drawing 12]



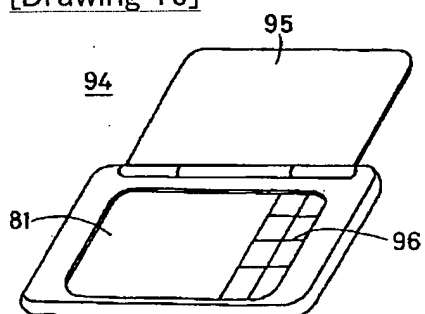
[Drawing 15]



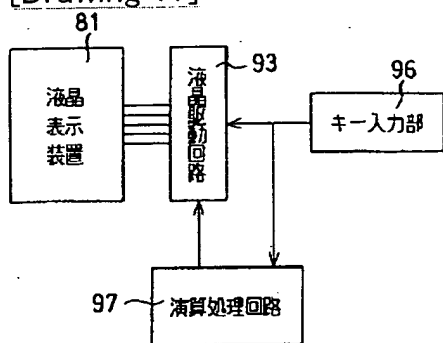
[Drawing 13]



[Drawing 16]



[Drawing 17]



[Translation done.]